


**PALM INTRANET**

Day : Wednesday  
Date: 11/17/2004  
Time: 15:11:32

## Inventor Name Search Result

Your Search was:

Last Name = BERGMAN

First Name = ERIC

Application#	Patent#	Status	Date Filed	Title	Inventor Name 51
<a href="#">60612664</a>	Not Issued	020	09/23/2004	PROTECTIVE GEAR	BERGMAN, ERIC M.O.
<a href="#">60019052</a>	Not Issued	159	05/06/1996	PRESENTATION OF LINK INFORMATION AS AN AID TO HYPERMEDIA NAVIGATION	BERGMAN , ERIC D.
<a href="#">10917094</a>	Not Issued	041	08/11/2004	PROCESSING A WORKPIECE WITH OZONE AND A HALOGENATED ADDITIVE	BERGMAN, ERIC J.
<a href="#">10870173</a>	Not Issued	030	06/18/2004	PROCESS AND APPARATUS FOR TREATING A WORKPIECE WITH GASES	BERGMAN, ERIC J.
<a href="#">10859668</a>	Not Issued	020	06/03/2004	PROCESS AND APPARATUS FOR TREATING A WORKPIECE USING OZONE	BERGMAN, ERIC J.
<a href="#">10721495</a>	Not Issued	030	11/25/2003	SINGLE WAFER CLEANING WITH OZONE	BERGMAN, ERIC
<a href="#">10692829</a>	Not Issued	095	10/23/2003	METHODS FOR REMOVING METALLIC CONTAMINATION FROM WAFER CONTAINERS	BERGMAN, ERIC J.
<a href="#">10681553</a>	Not Issued	093	10/07/2003	METHODS FOR CLEANING SEMICONDUCTOR SURFACES	BERGMAN, ERIC J.
<a href="#">10655210</a>	Not Issued	041	09/04/2003	MULTI-PROCESS SYSTEM	BERGMAN, ERIC
<a href="#">10654849</a>	Not Issued	030	09/04/2003	WORKPIECE PROCESSING SYSTEM	BERGMAN, ERIC J.
<a href="#">10631378</a>	Not Issued	030	07/30/2003	STATIONARY WAFER SPIN/SPRAY PROCESSOR	BERGMAN, ERIC J.
<a href="#">10631376</a>	Not Issued	030	07/30/2003	METHODS OF THINNING A SILICON WAFER USING HF AND OZONE	BERGMAN, ERIC J.

<u>10608789</u>	Not Issued	041	06/26/2003	CLEANING AND DRYING A SUBSTRATE	BERGMAN, ERIC J.
<u>10464597</u>	Not Issued	030	06/18/2003	VAPOR PHASE ETCHING MEMS DEVICES	BERGMAN, ERIC J.
<u>10420659</u>	<u>6817370</u>	150	04/21/2003	METHOD FOR PROCESSING THE SURFACE OF A WORKPIECE	BERGMAN, ERIC J.
<u>10418695</u>	Not Issued	093	04/18/2003	APPARATUS FOR TREATING A WORKPIECE WITH STEAM AND OZONE	BERGMAN, ERIC J.
<u>10397946</u>	Not Issued	041	03/25/2003	WAFER HANDLING SYSTEM	BERGMAN, ERIC J.
<u>10334457</u>	<u>6745494</u>	150	12/30/2002	METHOD AND APPARATUS FOR PROCESSING WAFERS UNDER PRESSURE	BERGMAN, ERIC J.
<u>10247560</u>	Not Issued	030	09/20/2002	SYSTEMS AND METHODS FOR CALIBRATING EMULATED DEVICE PERFORMANCE	BERGMAN, ERIC D.
<u>10224625</u>	Not Issued	161	08/20/2002	METHODS FOR REMOVING METALLIC CONTAMINATION FROM WAFER CONTAINERS	BERGMAN, ERIC J.
<u>10200071</u>	Not Issued	161	07/19/2002	METHODS FOR REMOVING METALLIC CONTAMINATION FROM WAFER CONTAINERS	BERGMAN, ERIC J.
<u>10101045</u>	<u>6543156</u>	150	03/18/2002	METHOD AND APPARATUS FOR HIGH-PRESSURE WAFER PROCESSING AND DRYING	BERGMAN, ERIC J.
<u>10055467</u>	Not Issued	041	01/22/2002	VAPOR CLEANING AND LIQUID RINSING PROCESS VESSEL	BERGMAN, ERIC J.
<u>10051860</u>	Not Issued	071	01/16/2002	PROCESSING A WORKPIECE USING OZONE AND SONIC ENERGY	BERGMAN, ERIC
<u>09934057</u>	<u>6560605</u>	150	08/21/2001	PRESENTATION OF LINK INFORMATION AS AN AID TO HYPERMEDIA NAVIGATION	BERGMAN, ERIC D.
<u>09929437</u>	<u>6582525</u>	150	08/14/2001	METHODS FOR PROCESSING A WORKPIECE USING STEAM AND OZONE	BERGMAN, ERIC J.
<u>09929312</u>	<u>6497768</u>	150	08/14/2001	PROCESS FOR TREATING A WORKPIECE WITH HYDROFLUORIC ACID AND	BERGMAN, ERIC J.

				OZONE	
<u>09925884</u>	Not Issued	041	08/06/2001	PROCESS FOR TREATING A FLAT MEDIA WORKPIECE	BERGMAN, ERIC
<u>09924999</u>	<u>6357142</u>	150	08/07/2001	METHOD AND APPARATUS FOR HIGH-PRESSURE WAFER PROCESSING AND DRYING	BERGMAN, ERIC J.
<u>09907544</u>	<u>6668844</u>	150	07/16/2001	SYSTEMS AND METHODS FOR PROCESSING WORKPIECES	BERGMAN, ERIC
<u>09907487</u>	<u>6427359</u>	150	07/16/2001	SYSTEMS AND METHODS FOR PROCESSING WORKPIECES	BERGMAN, ERIC
<u>09907485</u>	<u>6691720</u>	150	07/16/2001	MULTI-PROCESS SYSTEM WITH PIVOTING PROCESS CHAMBER	BERGMAN, ERIC
<u>09887873</u>	Not Issued	030	06/22/2001	METHOD AND APPARATUS FOR ENTRY AND EDITING OF SPREADSHEET FORMULAS	BERGMAN, ERIC D.
<u>09837722</u>	<u>6601594</u>	150	04/18/2001	APPARATUS AND METHOD FOR DELIVERING A TREATMENT LIQUID AND OZONE TO TREAT THE SURFACE OF A WORKPIECE	BERGMAN, ERIC J.
<u>09836080</u>	Not Issued	161	04/16/2001	METHODS FOR CLEANING SEMICONDUCTOR SURFACES	BERGMAN, ERIC J.
<u>09836059</u>	Not Issued	161	04/16/2001	METHODS FOR CLEANING SEMICONDUCTOR SURFACES	BERGMAN, ERIC J.
<u>09811925</u>	Not Issued	095	03/19/2001	METHODS FOR CLEANING SEMICONDUCTOR SURFACES	BERGMAN, ERIC J.
<u>09754411</u>	Not Issued	071	01/02/2001	CHANGE TRACKING INTEGRATED WITH DISCONNECTED DEVICE DOCUMENT SYNCHRONIZATION	BERGMAN, ERIC D.
<u>09741615</u>	<u>6401732</u>	150	12/19/2000	THERMOCAPILLARY DRYER	BERGMAN, ERIC J.
<u>09707244</u>	<u>6488038</u>	150	11/06/2000	METHOD FOR CLEANING SEMICONDUCTOR SUBSTRATES	BERGMAN, ERIC J.
<u>09704024</u>	Not Issued	161	11/01/2000	PRESENTATION OF LINK INFORMATION AS AN AID	BERGMAN, ERIC D.

				TO HYPERMEDIA NAVIGATION	
<u>09695625</u>	<u>6319841</u>	150	10/24/2000	SEMICONDUCTOR PROCESSING USING VAPOR MIXTURES	BERGMAN, ERIC J.
<u>09677934</u>	<u>6267125</u>	150	10/03/2000	APPARATUS AND METHOD FOR PROCESSING THE SURFACE OF A WORKPIECE WITH OZONE	BERGMAN, ERIC J.
<u>09677929</u>	<u>6273108</u>	150	10/03/2000	APPARATUS AND METHOD FOR PROCESSING THE SURFACE OF A WORKPIECE WITH OZONE	BERGMAN, ERIC J.
<u>09677925</u>	<u>6591845</u>	150	10/03/2000	APPARATUS AND METHOD FOR PROCESSING THE SURFACE OF A WORKPIECE WIH OZONE	BERGMAN, ERIC J.
<u>09621028</u>	Not Issued	093	07/21/2000	PROCESS AND APPARATUS FOR TREATING A WORKPIECE SUCH AS A SEMICONDUCTOR WAFER	BERGMAN, ERIC J.
<u>09536251</u>	<u>6701941</u>	150	03/27/2000	METHOD FOR TREATING THE SURFACE OF A WORKPIECE	BERGMAN, ERIC J.
<u>09481651</u>	<u>6286231</u>	150	01/12/2000	METHOD AND APPARATUS FOR HIGH-PRESSURE WAFER PROCESSING AND DRIVING	BERGMAN, ERIC J.
<u>09478870</u>	<u>6746565</u>	150	01/07/2000	SEMICONDUCTOR PROCESSOR WITH WAFER FACE PROTECTION	BERGMAN, ERIC J.
<u>09346208</u>	<u>6162734</u>	150	07/01/1999	SEMICONDUCTOR PROCESSING USING VAPOR MIXTURES	BERGMAN , ERIC J.
<u>08349691</u>	<u>5500081</u>	150	12/05/1994	DYNAMIC SEMICONDUCTOR WAFER PROCESSING USING HOMOGENEOUS CHEMICAL VAPORS	BERGMAN , ERIC J.

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<input type="checkbox"/>	L4	L3 and spraying	3
<input type="checkbox"/>	L3	L2 and oxidizing	48
<input type="checkbox"/>	L2	L1 and ((anhydrous HF) or (anhydrous hydrogen flouride))	194
<input type="checkbox"/>	L1	silicon wafer and etching	37085

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☐ 1. Document ID: US 5336356 A

Using default format because multiple data bases are involved.

L6: Entry 1 of 1

File: USPT

Aug 9, 1994

US-PAT-NO: 5336356

DOCUMENT-IDENTIFIER: US 5336356 A

TITLE: Apparatus for treating the surface of a semiconductor substrate

DATE-ISSUED: August 9, 1994

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Ban; Cozy	Itami			JP
Ohmori; Toshiaki	Itami			JP
Fukumoto; Takaaki	Itami			JP

US-CL-CURRENT: 156/345.26; 134/102.1, 134/3, 134/99.1, 156/345.27, 156/345.29,  
252/79.3, 257/E21.227

Full	Title	Citation	Front	Review	Classification	Date	Reference			Claims	KWIC	Draw De
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Term	Documents
SIF4	1439
SIF4S	1
(SIF4 AND 2).PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD.	1
(L2 AND SIF4).PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD.	1

Display Format:

[Previous Page](#)

[Next Page](#)

[Go to Doc#](#)

[First Hit](#)      [Previous Doc](#)      [Next Doc](#)      [Go to Doc#](#)

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L15: Entry 1 of 4

File: PGPB

Jan 31, 2002

PGPUB-DOCUMENT-NUMBER: 20020011257

PGPUB-FILING-TYPE: new

DOCUMENT-IDENTIFIER: US 20020011257 A1

TITLE: METHOD FOR REMOVING ORGANIC CONTAMINANTS FROM A SEMICONDUCTOR SURFACE

PUBLICATION-DATE: January 31, 2002

## INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY	RULE-47
DEGENDT, STEFAN	WIJNEGEM		BE	
SNEE, PETER	VELTEM-BEISEM		BE	
HEYNS, MARC	LINDEN		BE	
MERTENS, PAUL	Haacht		BE	
MEURIS, MARC	KEERBERGEN		BE	

APPL-NO: 09/ 207546      [\[PALM\]](#)

DATE FILED: December 8, 1998

CONTINUED PROSECUTION APPLICATION: This is a publication of a continued prosecution application (CPA) filed under 37 CFR 1.53(d).

## RELATED-US-APPL-DATA:

Application 09/207546 is a continuation-in-part-of US application 09/022834, filed February 13, 1998, PENDING

Application is a non-provisional-of-provisional application 60/040309, filed February 14, 1997,

Application is a non-provisional-of-provisional application 60/042389, filed March 25, 1997,

Application is a non-provisional-of-provisional application 60/066261, filed November 20, 1997,

INT-CL: [07] H01 L 21/302, C23 F 1/00

US-CL-PUBLISHED: 134/3; 438/745, 134/2, 134/26

US-CL-CURRENT: 134/3; 134/2, 134/26, 257/E21.226, 257/E21.252, 257/E21.255, 257/E21.256, 257/E21.577, 438/745

REPRESENTATIVE-FIGURES: 8

## ABSTRACT:

A method for removing organic contaminants from a semiconductor surface whereby the semiconductor is held in a tank and the tank is filled with a fluid such as a liquid or a gas. Organic contaminants, such as photoresist, photoresidue, and dry etched residue, occur in process steps of semiconductor fabrication and at times,

require removal. The organic contaminants are removed from the semiconductor surface by holding the semiconductor inside a tank. The method may be practiced using gas phase processing or liquid phase processing. The tank is filled with a gas mixture, a liquid, and/or a fluid, such as water, water vapor, ozone and/or an additive acting as a scavenger (a substance which counteracts the unwanted effects of other constituents of the system).

## REFERENCE TO RELATED APPLICATIONS

[0001] This application is a continuation-in-part of U.S. patent application Ser. No. 09/022,834 filed on Feb. 13, 1998 and claims priority benefits under 35 U.S.C. .sctn.119(e) to U.S. provisional application Serial No. 60/040,309, filed on Feb. 14, 1997, to U.S. provisional application Serial No. 60/042,389, filed on Mar. 25, 1997, and to U.S. provisional application Serial No. 60/066,261, filed on Nov. 20, 1997.

Previous Doc      Next Doc      Go to Doc#



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L1: Entry 1 of 1

File: USPT

Dec 24, 2002

US-PAT-NO: 6497768

DOCUMENT-IDENTIFIER: US 6497768 B2

TITLE: Process for treating a workpiece with hydrofluoric acid and ozone

DATE-ISSUED: December 24, 2002

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Bergman; Eric J.	Kalispell	MT		

US-CL-CURRENT: 134/3; 134/2, 134/25.4, 134/30, 134/31, 134/33, 134/41, 134/902,  
257/E21.228, 257/E21.229

CLAIMS:

What is claimed is:

1. A method of processing a workpiece, comprising the steps of: forming a layer of a heated liquid and HF on a surface of the workpiece; diffusing ozone through the liquid layer with the ozone reacting at the surface to process the workpiece; and controlling a thickness of the liquid layer on the surface of the workpiece wherein the ozone etches the surface of the workpiece with an etch uniformity of less than 5%.
2. The method of claim 1 wherein an ozone gas concentration is 10-20% by weight, in oxygen.
3. The method of claim 1 wherein the liquid comprises water and the ozone etches the surface of the workpiece in a substantially uniform manner, to process the workpiece.
4. The method of claim 3 wherein an HF concentration in the liquid is 0.01 to 1.0% by weight.
5. The method of claim 3 wherein the liquid further includes HCl.
6. The method of claim 5 wherein a ratio of water to HF to HCl is in a range of 500:1:1 to 50:1:1.
7. The method of claim 1 further including the step of heating the liquid to 65-100.degree. C.
8. The method of claim 1 wherein the workpiece surface is exposed to the liquid including the HF for 1-5 minutes.

9. The method of claim 1 wherein the HF is injected into the liquid.
10. The method of claim 1 wherein the workpiece comprises a silicon wafer.
11. The method of claim 10 wherein a concentration of ozone and HF are selected to avoid allowing the surface of the silicon wafer to become hydrophobic.
12. The method of claim 1 further comprising the step of controlling the thickness of the liquid layer by spinning the workpiece.
13. The method of claim 1 further comprising the step of controlling the thickness of the liquid layer by controlling a flow rate of the liquid onto the workpiece.
14. The method of claim 1 wherein the workpiece is processed in a chamber, and the ozone is introduced into the chamber as a gas.
15. The method of claim 1 wherein the ozone is injected into the liquid before the liquid is introduced onto the surface of the workpiece.
16. A method of processing one or more workpieces, comprising the steps of: heating a liquid to a temperature of at least 65.degree. C.; applying the heated liquid onto a surface of the workpiece; forming the heated liquid into a layer having a thickness on the surface of the workpiece; providing HF into the heated liquid layer; diffusing ozone through the heated liquid layer to process the workpiece by etching the surface of workpiece; and controlling the thickness of the heated liquid layer wherein the ozone etches the surface of the workpiece with an etch uniformity of less than 5%.
17. The method of claim 16 wherein the liquid is heated to a temperature of at least 65.degree. C.
18. The method of claim 16 wherein the liquid further comprises HCL.
19. The method of claim 16 wherein the HF is provided into the heated liquid layer by introducing HF into the liquid before the liquid is applied onto the surface of the workpiece.
20. The method of claim 16 further including the step of loading a batch of workpieces into a process chamber, and controlling the thickness of the heated liquid layer on the workpieces by rotating the workpieces.
21. A method of etching material from a surface of the workpiece, comprising the steps of: heating a liquid; providing the heated liquid onto the workpiece surface; heating the workpiece surface with the heated liquid; forming the heated liquid into a layer having a thickness on the workpiece surface; providing HF in the liquid layer; introducing ozone into an environment around the workpiece; diffusing ozone through the liquid layer; etching the material on the surface of the workpiece with the diffused ozone; and controlling the thickness of the liquid layer to maintain an etch uniformity of less than 5%.
22. The method of claim 21 wherein the thickness of the layer is controlled to maintain etch uniformity at less than 3%.

23. The method of claim 21 wherein the liquid is heated to a temperature of 65-100.degree. C.

24. The method of claim 21 further including the step of providing the heated liquid while concurrently rotating the workpiece to assist in forming the liquid layer.

25. The method of claim 21 wherein the step of providing the heated liquid comprises spraying the heated liquid onto the workpiece surface to form the liquid layer.

26. The method of claim 21 wherein the heated liquid further comprising HCl.

27. The method of claim 21 further comprising providing the HF in the liquid layer by adding a solution of HF to the liquid.

28. A method for cleaning a semiconductor wafer, comprising the steps of: forming a heated liquid layer containing HF on the wafer; allowing ozone to diffuse through the heated liquid layer and react with one or more contaminants on the wafer, to clean the wafer; and controlling a thickness of the heated liquid layer wherein the ozone etches the surface of the workpiece with an etch uniformity of less than 5%.

[Previous Doc](#)

[Next Doc](#)

[Go to Doc#](#)

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Clear	Generate Collection	Print	Fwd Refs	Bkwd Refs
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### Search Results - Record(s) 11 through 13 of 13 returned.

☐ 11. Document ID: US 5232511 A

L10: Entry 11 of 13

File: USPT

Aug 3, 1993

US-PAT-NO: 5232511

DOCUMENT-IDENTIFIER: US 5232511 A

TITLE: Dynamic semiconductor wafer processing using homogeneous mixed acid vapors

DATE-ISSUED: August 3, 1993

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Bergman; Eric J.	Kalispell	MT		

US-CL-CURRENT: 134/2; 134/1.3, 134/3, 134/31

ABSTRACT:

Disclosed are methods and apparatuses for combined etching and cleaning of semiconductor wafers and the like using a combined etchant and cleaning agent, particularly hydrofluoric acid (HF) and hydrochloric acid in water mixtures. Homogeneous vapor mixtures are generated from homogeneous liquid phase mixtures which are preferably recirculated, mixed and agitated. The liquid phase is advantageously circulated through a chemical chamber within the processing bowl. Exposure of wafers to vapors from the chemical chamber can be controlled by a vapor control valve which is advantageously the bottom of the processing chamber. The wafer is rotated or otherwise moved within the processing chamber to provide uniform dispersion of the homogeneous reactant vapors across the wafer surface and to facilitate vapor circulation to the processed surface. A radiative volatilization processor can be utilized to volatilize reaction by-products which form under some conditions. The processes provide efficient uniform etching and cleaning to provide low particle count performance.

119 Claims, 26 Drawing figures

Exemplary Claim Number: 1

Number of Drawing Sheets: 19

Full	Title	Citation	Front	Review	Classification	Date	Reference			Claims	KUMC	Drawn
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☐ 12. Document ID: US 5181985 A

L10: Entry 12 of 13

File: USPT

Jan 26, 1993

US-PAT-NO: 5181985

DOCUMENT-IDENTIFIER: US 5181985 A

TITLE: Process for the wet-chemical surface treatment of semiconductor wafers

DATE-ISSUED: January 26, 1993

## INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Lampert; Ingolf	Burghausen			DE
Gratzl; Christa	Neuotting			DE

US-CL-CURRENT: 438/748; 134/11, 134/28, 134/31, 134/902, 257/E21.227, 257/E21.228, 438/750, 438/753

## ABSTRACT:

A process for the wet-chemical surface treatment of semiconductor wafers in which aqueous phases containing one or more chemically active substances in solution act on the wafer surfaces, consisting of spraying a water mist over the wafer surfaces and then introducing chemically active substances in the gaseous state so that these gaseous substances combine with the water mist so that there is an interaction of the gas phase and the liquid phase taking place on the surface of the semiconductor wafer. Gases such as hydrogen fluoride, chlorine and ozonized oxygen or other halogen gases act on the wafer surfaces between rinsing steps so that when the wafers are dried, the surfaces achieve extremely high cleanliness levels.

18 Claims, 0 Drawing figures

Exemplary Claim Number: 1

Full	Title	Citation	Front	Review	Classification	Date	Reference			Claims	KMC	Draw. De
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☐ 13. Document ID: US 4695327 A

L10: Entry 13 of 13

File: USPT

Sep 22, 1987

US-PAT-NO: 4695327

DOCUMENT-IDENTIFIER: US 4695327 A

TITLE: Surface treatment to remove impurities in microrecesses

DATE-ISSUED: September 22, 1987

## INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Grebinski; Thomas J.	Sunnyvale	CA		

US-CL-CURRENT: 134/11; 134/28, 134/30, 257/E21.226, 257/E21.228, 257/E21.229

## ABSTRACT:

A surface of an object, e.g., a semiconductor wafer, is treated to remove impurities, including those in microrecesses having minimum dimensions of ten microns or less. The object is positioned in a sealed chamber which has a limited number of potential spaceborne nucleation centers and is at a treating temperature, T. A condensable solvent is introduced into the chamber until its pressure is close to but below its vapor pressure at the temperature, T. This condition is maintained until a plurality of molecular layers of the solvent is adsorbed in the microrecesses. Then, the pressure of the solvent is increased to at least unity whereat it condenses in the microrecesses. Impurities can be removed from the microrecesses in this manner thus improving product quality.

10 Claims, 0 Drawing figures

Exemplary Claim Number: 1

Full	Title	Citation	Front	Review	Classification	Date	Reference	Claims	KUMC	Draw. De
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Clear	Generate Collection	Print	Fwd Refs	Bkwd Refs	Generate OACS
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Term	Documents
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4695327S	0
"4974530"	1
4974530S	0
"5055138"	1
5055138S	0
"5120370"	1
5120370S	0
"5181985"	1
5181985S	0
"5232511"	1
((4695327 OR 4974530 OR 5055138 OR 5120370 OR 5181985 OR 5232511 OR 5234540 OR 5235995 OR 5244000 OR 5248380 OR 5308745 OR 5378317 OR 5415191 OR 5464480 OR 5503708 OR 5520744 OR 5632847 OR 5647386 OR 5658615 OR 5705089 OR 5714203 OR 5749975 OR 5776296 OR 5803982 OR 5858107 OR 5896875 OR 5911837).PN. AND (ETCHING OR THINNING)).USPT.	13

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[Previous Page](#)

[Next Page](#)

[Go to Doc#](#)

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Clear	Generate Collection	Print	Fwd Refs	Bkwd Refs
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☐ 1. Document ID: US 5911837 A

L10: Entry 1 of 13

File: USPT

Jun 15, 1999

US-PAT-NO: 5911837

DOCUMENT-IDENTIFIER: US 5911837 A

TITLE: Process for treatment of semiconductor wafers in a fluid

DATE-ISSUED: June 15, 1999

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Matthews; Robert Roger	Richmond	CA		

US-CL-CURRENT: 134/2; 134/25.4, 134/26, 134/30, 134/31, 134/37, 134/902

ABSTRACT:

A process for removing organic materials from semiconductor wafers and a process for chemical solvent drying of wafers. In the drying process, a wafer submerged in a bath having a lower aqueous layer and an upper organic layer is lifted from the lower aqueous layer up through the upper organic layer and removed from the bath.

8 Claims, 4 Drawing figures

Exemplary Claim Number: 1

Number of Drawing Sheets: 3

Full	Title	Citation	Front	Review	Classification	Date	Reference			Claims	KWIC	Draw De
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☐ 2. Document ID: US 5896875 A

L10: Entry 2 of 13

File: USPT

Apr 27, 1999

US-PAT-NO: 5896875

DOCUMENT-IDENTIFIER: US 5896875 A

TITLE: Equipment for cleaning, etching and drying semiconductor wafer and its using method

DATE-ISSUED: April 27, 1999

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Yoneda; Kenji	Kyoto			JP

US-CL-CURRENT: 134/102.3; 134/100.1, 134/102.1, 134/176, 134/179, 134/2, 134/26,  
134/3, 134/30, 134/31, 134/37, 134/45, 134/902, 257/E21.219, 257/E21.228

## ABSTRACT:

An equipment for cleaning, etching and drying a semiconductor wafer is provided with a process chamber having a closed space of which temperature is capable of being heated and adjusted by a heater; a mesh arranged at the center part in the process chamber and supporting at least one semiconductor wafer to be cleaned; a plurality of spray nozzles arranged in line at the upper part in the process chamber; and a rotary discharge nozzle arranged at the lower part in the process chamber. The spray nozzles spray chemical and ultrapure water with nitrogen gas in mist state, and the rotary discharge nozzle blows out chemical and ultrapure water as jet stream by rotation of a first arm and second arms thereof.

11 Claims, 9 Drawing figures

Exemplary Claim Number: 1

Number of Drawing Sheets: 9

Full	Title	Citation	Front	Review	Classification	Date	Reference			Claims	KWIC	Draw De
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☐ 3. Document ID: US 5776296 A

L10: Entry 3 of 13

File: USPT

Jul 7, 1998

US-PAT-NO: 5776296

DOCUMENT-IDENTIFIER: US 5776296 A

TITLE: Apparatus for the treatment of semiconductor wafers in a fluid

DATE-ISSUED: July 7, 1998

## INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Matthews; Robert Roger	Richmond	CA		

US-CL-CURRENT: 156/345.11; 134/102.2, 134/902, 257/E21.224, 261/122.1

## ABSTRACT:

Provided is a process for removing organic materials from semiconductor wafers. The process involves the use of subambient deionized water with ozone absorbed into the water. The ozonated water flows over the wafers and the ozone oxidizes the organic materials from the wafers to insoluble gases. The ozonated water may be prepared in-situ by diffusing ozone into a tank containing wafers and subambient deionized water.

Also provided is a tank for the treatment of semiconductor wafers with a fluid and a gas diffuser for diffusion of gases directly into fluids in a wafer treatment tank.



11 Claims, 3 Drawing figures  
Exemplary Claim Number: 1  
Number of Drawing Sheets: 2

Full	Title	Citation	Front	Review	Classification	Date	Reference			Claims	KMC	Draw De
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☐ 4. Document ID: US 5749975 A

L10: Entry 4 of 13

File: USPT

May 12, 1998

US-PAT-NO: 5749975  
DOCUMENT-IDENTIFIER: US 5749975 A

TITLE: Process for dry cleaning wafer surfaces using a surface diffusion layer

DATE-ISSUED: May 12, 1998

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Li; Li	Meridian	ID		
Hawthorne; Richard C.	Nampa	ID		

US-CL-CURRENT: 134/1.3; 134/1, 134/2, 134/26, 134/30, 257/E21.226

ABSTRACT:

Disclosed is a method for dry cleaning a silicon surface on an in-process integrated circuit wafer which can be conducted in situ in a cluster tool or a reaction chamber where a previous etch or oxide removal step is conducted. The first step in the method is providing a silicon surface on the wafer which is to be cleaned of contaminates. Next, the wafer is located in a reaction chamber where the etch or oxide removal step is conducted. An adsorbent surface diffusion layer typically comprising a thin water or solvent layer in liquid state is then adhered to the silicon surface in the reaction chamber. Finally, the silicon surface is exposed to ultraviolet radiation and at least one gaseous cleaning agent while the surface diffusion layer is adhered on the silicon surface. A clean silicon surface results which does not exhibit the surface roughness typical of conventional dry cleaning processes.

17 Claims, 0 Drawing figures  
Exemplary Claim Number: 1

Full	Title	Citation	Front	Review	Classification	Date	Reference			Claims	KMC	Draw De
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☐ 5. Document ID: US 5464480 A

L10: Entry 5 of 13

File: USPT

Nov 7, 1995

US-PAT-NO: 5464480  
DOCUMENT-IDENTIFIER: US 5464480 A

TITLE: Process and apparatus for the treatment of semiconductor wafers in a fluid

DATE-ISSUED: November 7, 1995

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Matthews; Robert R.	Richmond	CA		

US-CL-CURRENT: 134/1.3; 134/31, 134/37, 134/902, 216/57, 216/83, 216/94,  
257/E21.228, 438/745

ABSTRACT:

Provided is a process for removing organic materials from semiconductor wafers. The process involves the use of subambient deionized water with ozone absorbed into the water. The ozonated water flows over the wafers and the ozone oxidizes the organic materials from the wafers to insoluble gases. The ozonated water may be prepared in-situ by diffusing ozone into a tank containing wafers and subambient deionized water. Also provided is a tank for the treatment of semiconductor wafers with a fluid and a gas diffuser for diffusion of gases directly into fluids in a wafer treatment tank.

19 Claims, 3 Drawing figures

Exemplary Claim Number: 1

Number of Drawing Sheets: 2

Full	Title	Citation	Front	Review	Classification	Date	Reference			Claims	KINC	Draw. De
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☐ 6. Document ID: US 5415191 A

L10: Entry 6 of 13

File: USPT

May 16, 1995

US-PAT-NO: 5415191

DOCUMENT-IDENTIFIER: US 5415191 A

TITLE: Arrangement for cleaning semiconductor wafers using mixer

DATE-ISSUED: May 16, 1995

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Mashimo; Noriyoshi	Tokyo			JP
Okumura; Katsuya	Yokohama			JP

US-CL-CURRENT: 134/102.1; 134/102.2, 134/902, 261/94

ABSTRACT:

For cleaning semiconductor wafers in a cleaning vessel by supplying a cleaning fluid through a supply line thereto, a mixer is provided. Deionized water is supplied to the mixer through a deionized water supply line, and a cleaning gas is supplied thereto from a gas reservoir to produce the cleaning fluid. After treating

the semiconductor wafers with the cleaning fluid, the deionized water is supplied to the cleaning vessel to rinse them.

8 Claims, 8 Drawing figures

Exemplary Claim Number: 1

Number of Drawing Sheets: 5

Full	Title	Citation	Front	Review	Classification	Date	Reference			Claims	KWIC	Draw. De
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☐ 7. Document ID: US 5378317 A

L10: Entry 7 of 13

File: USPT

Jan 3, 1995

US-PAT-NO: 5378317

DOCUMENT-IDENTIFIER: US 5378317 A

TITLE: Method for removing organic film

DATE-ISSUED: January 3, 1995

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Kashiwase; Masaharu	Okayama			JP
Matsuoka; Terumi	Okayama			JP

US-CL-CURRENT: 438/704; 134/2, 257/E21.255, 438/749, 438/980

ABSTRACT:

The method for removing organic film according to the present invention is very effective for removing a photo resist film in a process for manufacturing semiconductor device. A substrate (32) having a photo resist film (31) formed on it is processed in a wet processing tank (34) filled with a processing solution such as a mixed solution containing sulfuric acid and hydrogen peroxide or by a dry processing using oxygen plasma. Then, it is processed in an ozone processing tank (34) filled with a solution where ozone or ozone water has been infused, and the organic film is removed.

4 Claims, 7 Drawing figures

Exemplary Claim Number: 1

Number of Drawing Sheets: 3

Full	Title	Citation	Front	Review	Classification	Date	Reference			Claims	KWIC	Draw. De
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☐ 8. Document ID: US 5248380 A

L10: Entry 8 of 13

File: USPT

Sep 28, 1993

US-PAT-NO: 5248380

DOCUMENT-IDENTIFIER: US 5248380 A

**\*\* See image for Certificate of Correction \*\***

TITLE: Method of treating surface of rotating wafer using surface treating gas

DATE-ISSUED: September 28, 1993

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Tanaka; Masato	Shiga			JP

US-CL-CURRENT: 216/59; 134/31, 134/33, 427/255.5, 427/8

ABSTRACT:

A surface treatment method of treating a main surface of a wafer by a surface treating gas while rotating the wafer at a predetermined rotation speed includes the steps of: determining, before surface treatment of the product wafer, a first rotation speed at which the result of a comparison between the speed of surface treatment in the center of rotation of the main surface of a product wafer and the speed of surface treatment in the periphery of it is inverted; and supplying a surface treating gas to the main surface of the product wafer while rotating the product wafer at the determined first rotation speed. The first rotation speed is selected to be corresponding to the inflection point of a curved line of a function which represents the relation between the surface treatment rate and the rotation speed of the wafer. Surface treatment is carried out at uniform treatment rate over the whole surface of the wafer by rotating the wafer the first rotation speed.

23 Claims, 13 Drawing figures

Exemplary Claim Number: 1

Number of Drawing Sheets: 13

Full	Title	Citation	Front	Review	Classification	Date	Reference			Claims	KNOW	Draw De
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9. Document ID: US 5235995 A

L10: Entry 9 of 13

File: USPT

Aug 17, 1993

US-PAT-NO: 5235995

DOCUMENT-IDENTIFIER: US 5235995 A

TITLE: Semiconductor processor apparatus with dynamic wafer vapor treatment and particulate volatilization

DATE-ISSUED: August 17, 1993

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Bergman; Eric J.	Kalispell	MT		
Reardon; Timothy J.	Kalispell	MT		
Thompson; Raymon F.	Lakeside	MT		
Owczarz; Aleksander	Kalispell	MT		

US-CL-CURRENT: 134/105; 134/157, 134/182, 134/200, 134/902

## ABSTRACT:

Disclosed are apparatuses and methods for improved processing of semiconductor wafers and the using vapor phase processing chemicals, particularly aqueous hydrofluoric acid etchants. Homogeneous vapor mixtures are generated from homogeneous liquid mixtures. Means for recirculating, mixing and agitating the liquid phase reactants are provided. In some embodiments the liquid phase is advantageously circulated through a chemical trench within the processing bowl. Exposure of wafers to vapors from the chemical trench can be controlled by a vapor control valve which is advantageously the bottom of the processing chamber. The wafer is rotated or otherwise moved within the processing chamber to provide uniform dispersion of the homogeneous reactant vapors across the wafer surface and to facilitate vapor circulation to the processed surface. A radiative volatilization processor can be utilized to volatilize reaction by-products which form under some conditions. The apparatuses provide efficient uniform etching with low particle count performance.

30 Claims, 26 Drawing figures

Exemplary Claim Number: 1

Number of Drawing Sheets: 19

Full	Title	Citation	Front	Review	Classification	Data	Reference			Claims	KUMC	Draw De
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☐ 10. Document ID: US 5234540 A

L10: Entry 10 of 13

File: USPT

Aug 10, 1993

US-PAT-NO: 5234540

DOCUMENT-IDENTIFIER: US 5234540 A

TITLE: Process for etching oxide films in a sealed photochemical reactor

DATE-ISSUED: August 10, 1993

## INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Grant; Robert W.	Excelsior	MN		
Torek; Kevin	State College	PA		
Novak; Richard E.	Plymouth	MN		
Ruzyllo; Jerzy	State College	PA		

US-CL-CURRENT: 216/63; 216/76, 216/80, 257/E21.252

## ABSTRACT:

A process for etching oxide films on the semiconductor, or other substrates, in a sealed photochemical reactor. Anhydrous hydrogen fluoride (AHF) gas, or other halogen containing gases, and alcohol vapor carried by an inert gas, such as nitrogen, are passed over the oxides to be etched. The UV radiation shines through a window, which passes the UV radiation onto the oxides while the gases are flowing, and enhances and controls etching of the oxides. The UV window is impervious to the etch process gases. The etch rates are modified, providing for improved oxide etching characteristics.

1 Claims, 1 Drawing figures  
Exemplary Claim Number: 1  
Number of Drawing Sheets: 1

Full	Title	Citation	Front	Review	Classification	Date	Reference			Claims	KWC	Draw De
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☐ 1. Document ID: US 5911837 A

L13: Entry 1 of 3

File: USPT

Jun 15, 1999

US-PAT-NO: 5911837

DOCUMENT-IDENTIFIER: US 5911837 A

TITLE: Process for treatment of semiconductor wafers in a fluid

DATE-ISSUED: June 15, 1999

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Matthews; Robert Roger	Richmond	CA		

US-CL-CURRENT: 134/2; 134/25.4, 134/26, 134/30, 134/31, 134/37, 134/902

ABSTRACT:

A process for removing organic materials from semiconductor wafers and a process for chemical solvent drying of wafers. In the drying process, a wafer submerged in a bath having a lower aqueous layer and an upper organic layer is lifted from the lower aqueous layer up through the upper organic layer and removed from the bath.

8 Claims, 4 Drawing figures

Exemplary Claim Number: 1

Number of Drawing Sheets: 3

Full	Title	Citation	Front	Review	Classification	Date	Reference			Claims	KWIC	Draw De
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☐ 2. Document ID: US 5896875 A

L13: Entry 2 of 3

File: USPT

Apr 27, 1999

US-PAT-NO: 5896875

DOCUMENT-IDENTIFIER: US 5896875 A

TITLE: Equipment for cleaning, etching and drying semiconductor wafer and its using method

DATE-ISSUED: April 27, 1999

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Yoneda; Kenji	Kyoto			JP

US-CL-CURRENT: 134/102.3; 134/100.1, 134/102.1, 134/176, 134/179, 134/2, 134/26,  
134/3, 134/30, 134/31, 134/37, 134/45, 134/902, 257/E21.219, 257/E21.228

## ABSTRACT:

An equipment for cleaning, etching and drying a semiconductor wafer is provided with a process chamber having a closed space of which temperature is capable of being heated and adjusted by a heater; a mesh arranged at the center part in the process chamber and supporting at least one semiconductor wafer to be cleaned; a plurality of spray nozzles arranged in line at the upper part in the process chamber; and a rotary discharge nozzle arranged at the lower part in the process chamber. The spray nozzles spray chemical and ultrapure water with nitrogen gas in mist state, and the rotary discharge nozzle blows out chemical and ultrapure water as jet stream by rotation of a first arm and second arms thereof.

11 Claims, 9 Drawing figures

Exemplary Claim Number: 1

Number of Drawing Sheets: 9

Full	Title	Citation	Front	Review	Classification	Date	Reference			Claims	KMCD	Drawn De
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☐ 3. Document ID: US 5181985 A

L13: Entry 3 of 3

File: USPT

Jan 26, 1993

US-PAT-NO: 5181985

DOCUMENT-IDENTIFIER: US 5181985 A

TITLE: Process for the wet-chemical surface treatment of semiconductor wafers

DATE-ISSUED: January 26, 1993

## INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Lampert; Ingolf	Burghausen			DE
Gratzl; Christa	Neuotting			DE

US-CL-CURRENT: 438/748; 134/11, 134/28, 134/31, 134/902, 257/E21.227, 257/E21.228,  
438/750, 438/753

## ABSTRACT:

A process for the wet-chemical surface treatment of semiconductor wafers in which aqueous phases containing one or more chemically active substances in solution act on the wafer surfaces, consisting of spraying a water mist over the wafer surfaces and then introducing chemically active substances in the gaseous state so that these gaseous substances combine with the water mist so that there is an interaction of the gas phase and the liquid phase taking place on the surface of the semiconductor wafer. Gases such as hydrogen fluoride, chlorine and ozonized oxygen or other halogen gases act on the wafer surfaces between rinsing steps so



that when the wafers are dried, the surfaces achieve extremely high cleanliness levels.

18 Claims, 0 Drawing figures

Exemplary Claim Number: 1

Full	Title	Citation	Front	Review	Classification	Date	Reference			Claims	KWIC	Draw De
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